A Novel Nonparaxial Time-Domain Beam-Propagation Method For Modeling Ultrashort Pulses In Optical Structures

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Summary

In this paper, a new nonparaxial time-domain beam-propagation method (TD-BPM) based on Pade approximant for modeling ultrashort optical pulses has been proposed and verified. The high efficiency of the technique in modeling long device interaction comes from solving the TD wave equation along one direction and allowing the time window to follow the evolution of the pulse. The accuracy of the method was tested in three different environments of homogenous and nondispersive medium, metallic, and dielectric waveguides and then was applied to model ultrashort pulse propagation in a directional-coupler device. The characterization of the technique shows excellent performance in terms of accuracy, efficiency, and stability, which the conventional paraxial TD-BPM failed to achieve. The new TD-BPM is particularly well suited for the study of unidirectional propagation of compact ultrashort temporal pulses over long distances in waveguide structures. [All rights reserved Elsevier].